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# COOLING SYSTEM

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JCO00001-00000

# CHECK & CHANGE OF ENGINE COOLANT

## PRECAUTIONS

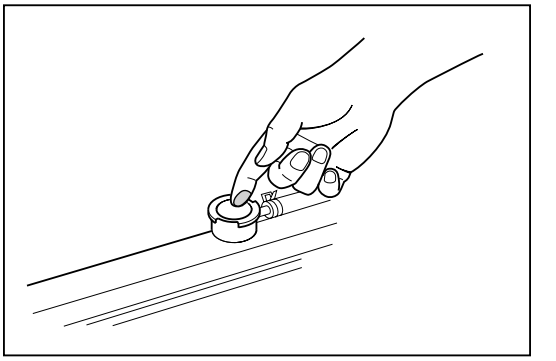
WARNING:
- If the coolant gets to the vehicle body, immediately flush away the coolant using water.
- Never open the radiator cap when the engine is still hot. Failure to observe this caution will cause you to get scalded.
- The inside of the radiator is under a pressurized condition when the cooling water is hot. Therefore, if the radiator cap should be removed, the cooling water will blow off, possibly causing injuries such as scald.

CAUTION:
- Here, the coolant refers to the mixture of water and antifreeze of a reliable brand that has been mixed in accordance with the instructions of the antifreeze manufacturer.

JCO00002-00000

## CHECK OF ENGINE COOLANT QUALITY

There should be no excessive deposits of rust or water scales around the radiator cap or the radiator filler hole. Also, the coolant should be free of oil.
Change the coolant if it is excessively dirty.



JCO00003-00001

## CHECK OF ENGINE COOLANT LEVEL

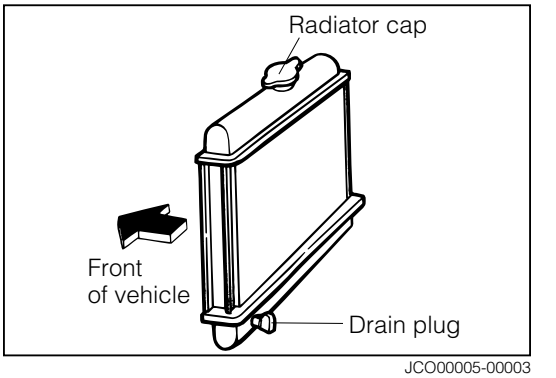
Check to see if the coolant level is between the L and F lines of the reserve tank.
If the coolant level is near the low level or below the low level, add the coolant up to the full level.

NOTE:
- If no coolant is present in the reserve tank or the coolant level is very low, check for water leakage, using a radiator cap tester. (Refer to the page CO–13.)

JCO00004-00000

## CHANGE OF ENGINE COOLANT

CAUTION:
- Be sure to perform the coolant change after the engine has cooled down.
  Furthermore, with regard to the engine coolant changing procedure, be sure to refer to the engine service information label affixed to the body.

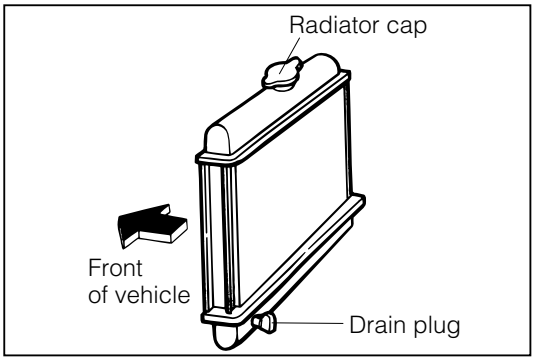



JCO00005-00003

## 1. DRAIN ENGINE COOLANT

### M101 & M201 Series

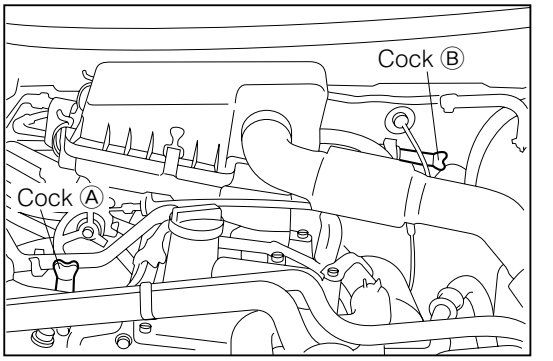
(1) Remove the radiator cap.
(2) Drain the coolant by loosing the radiator drain plug.




YCO00006-00003

### J102 Series

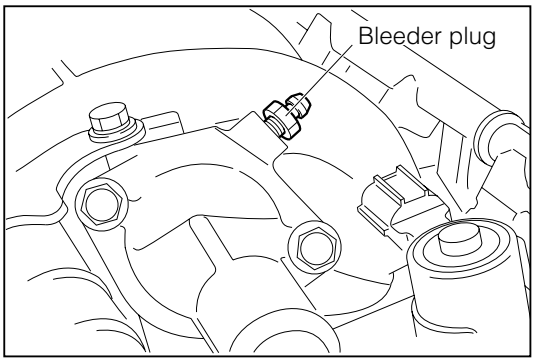
(1) Remove the radiator cap.
(2) Loosen and remove the cocks (white) of the air bleeding valves Ⓐ and Ⓑ.
(3) Drain the coolant by loosing the radiator drain plug.




YCO00007-00004

### S221 Series

(1) Remove the radiator cap.
(2) Drain the coolant by loosening the radiator drain plug.
(3) Loosen the bleeder plug located at the top of the engine water outlet housing.




YCO00008-00005

## 2. FILL ENGINE COOLANT

### M101 & M201 Series

(1) Tighten the drain plug of the radiator. Fill the radiator with water.

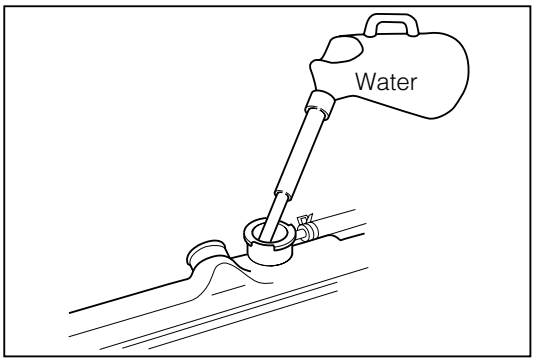
CAUTION:

- As regards water to be used as cooling water, use soft water which does not contain salts of minerals, calcium, magnesium, and so forth.

NOTE:

- The operations described in steps (1) through (5) are to completely expel any deteriorated coolant remaining in the cooling system.

(2) Tighten the radiator cap.
(3) Start the engine, and keep warming up the engine and then stop the engine and allow it to cool down.
(4) Drain the water. (Refer to page CO–3.)
(5) Repeat the steps (1) through (4) two to three times.



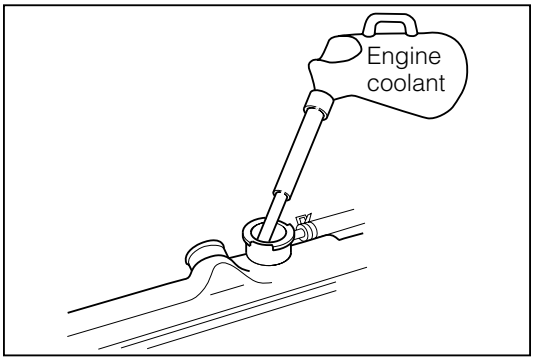

YCO00009-00006

YCO00010-00000

(6) Tighten the drain plug of the radiator. Fill the radiator with coolant in accordance with the instructions of the manufacturer of the antifreeze solution.

CAUTION:

- Use a reliable brand of ethylene-glycol base antifreeze solution.
  Coolant Capacity: 3.8 ℓ (W/heater, W/O reserve tank)
  Reserve Tank Capacity:
  Full: 0.45 ℓ
  Low: 0.25 ℓ



YCO00011-00007

(7) Tighten the radiator cap. Also add the coolant to the reserve tank.
(8) Warm up the engine until the cooling fan operates twice, and then stop the engine.
(9) After the engine has cooled down, fill the radiator with coolant and add the coolant up to the full level of the reserve tank.

YCO00012-00000

**J102 Series**

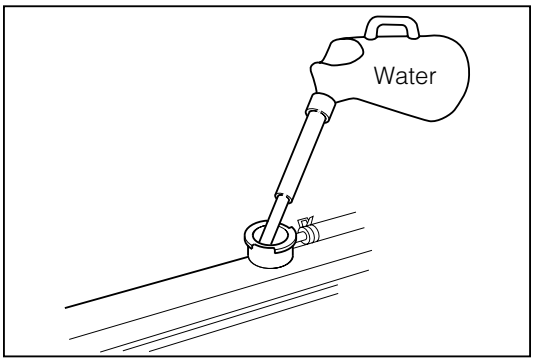
(1) Tighten the drain plug of the radiator. Fill the radiator with water.

CAUTION:

- As regards water to be used as cooling water, use soft water which does not contain salts of minerals, calcium, magnesium, and so forth.

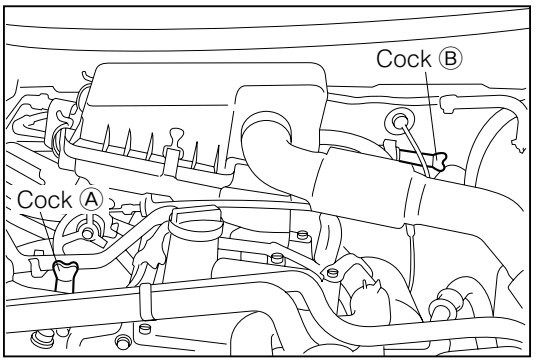
NOTE:

- The operations described in steps (1) through (7) are to completely expel any deteriorated coolant remaining in the cooling system.



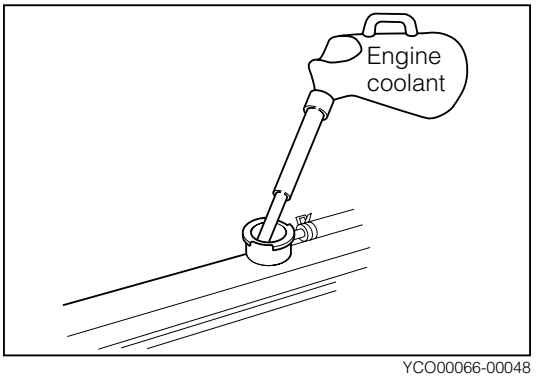
YCO00013-00008

(2) Tighten the cock Ⓐ when the water starts to overflow from the air bleeding valve Ⓐ.
(3) Tighten the cock Ⓑ when the water starts to overflow from the air bleeding valve Ⓑ.
(4) Tighten the radiator cap when the water starts to overflow from the radiator.



YCO00014-00009

(5) Start the engine, and keep warming up the engine and then stop the engine and allow it to cool down.
(6) Drain the water. (Refer to page CO–3.)
(7) Repeat the steps (1) through (6) two to three times.



YCO00066-00048

(8) Tighten the drain plug of the radiator. Fill the radiator with coolant in accordance with the instructions of the manufacturer of the antifreeze solution.

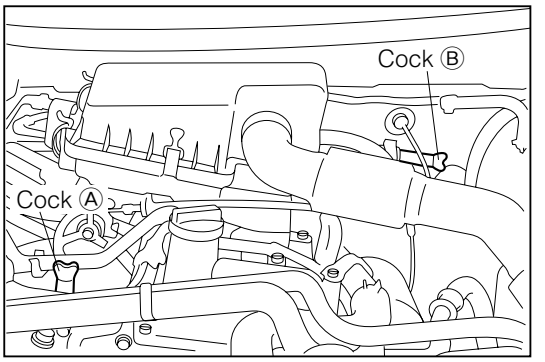
CAUTION:

- Use a reliable brand of ethylene-glycol base antifreeze solution.

Coolant Capacity: (W/heater, W/O reserve tank)
MT: 5.80 ℓ
AT: 5.72 ℓ
Reserve Tank Capacity: 0.95 ℓ

(9) Tighten the cock Ⓐ when the coolant starts to overflow from the air bleeding valve Ⓐ.
(10) Tighten the cock Ⓑ when the coolant starts to overflow from the air bleeding valve Ⓑ.
(11) Tighten the radiator cap when the coolant starts to overflow from the radiator. Also add the coolant to the reserve tank.

sCO00067-00000




sCO00068-00049

(12) Warm up the engine until the cooing fan operates twice, and then stop the engine.
(13) After the engine has cooled down, fill the radiator with the coolant and add the coolant up to the full level of the reserve tank.

NOTE:

If no coolant overflows from the air bleeding valves Ⓐ or Ⓑ, or no coolant overflows from both valves Ⓐ and Ⓑ in steps (9) and (10) above, tighten the cocks of the air bleeding valves after coolant overflows from the radiator.

**S221 Series**

(1) Tighten the drain plug of the radiator. Fill the radiator with water.

CAUTION:

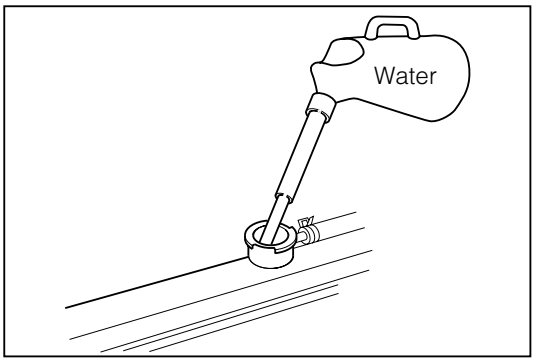
- As regards water to be used as cooling water, use soft water which does not contain salts of minerals, calcium, magnesium, and so forth.

NOTE:

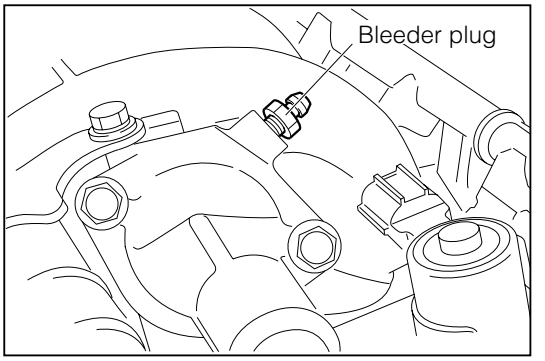
- The operations described in steps (1) through (6) are to completely expel any deteriorated coolant remaining in the cooling system.

(2) Tighten the bleeder plug when the water starts to overflow from the bleeder plug.
(3) Tighten the radiator cap when the water starts to overflow from the radiator.

sCO00069-00000




sCO00070-00050




sCO00071-00051

(4) Start the engine, and keep warming up the engine and then stop the engine and allow it to cool down.
(5) Drain the water. (Refer to page CO–3.)
(6) Repeat the steps (1) through (5) two to three times.

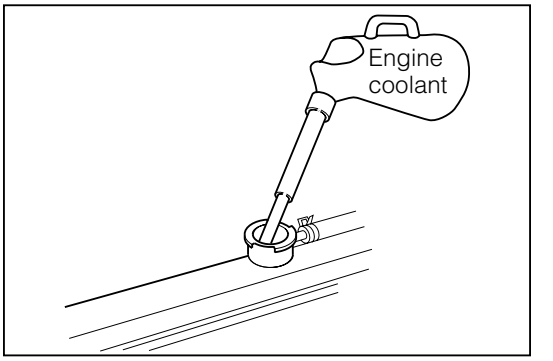
sCO00072-00000

(7) Tighten the drain plug of the radiator. Fill the radiator with coolant in accordance with the instructions of the manufacturer of the antifreeze solution.

CAUTION:

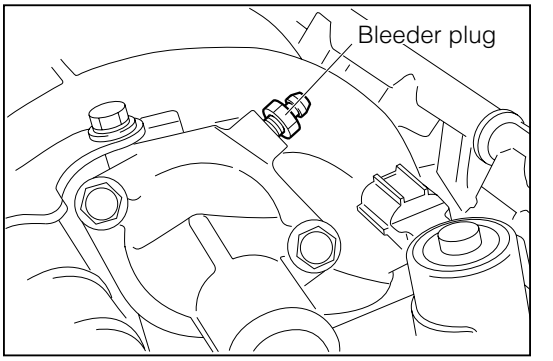
- Use a reliable brand of ethylene-glycol base antifreeze solution.

Coolant Capacity: (W/heater, W/O reserve tank)
MT: 6.50 ℓ
AT: 6.70 ℓ
Reserve Tank Capacity: 0.7 ℓ




sCO00073-00052

(8) Tighten the bleeder plug when the coolant starts to overflow from the bleeder plug.
(9) Tighten the radiator cap when the coolant starts to overflow from the radiator. Also add the coolant to the reserve tank.



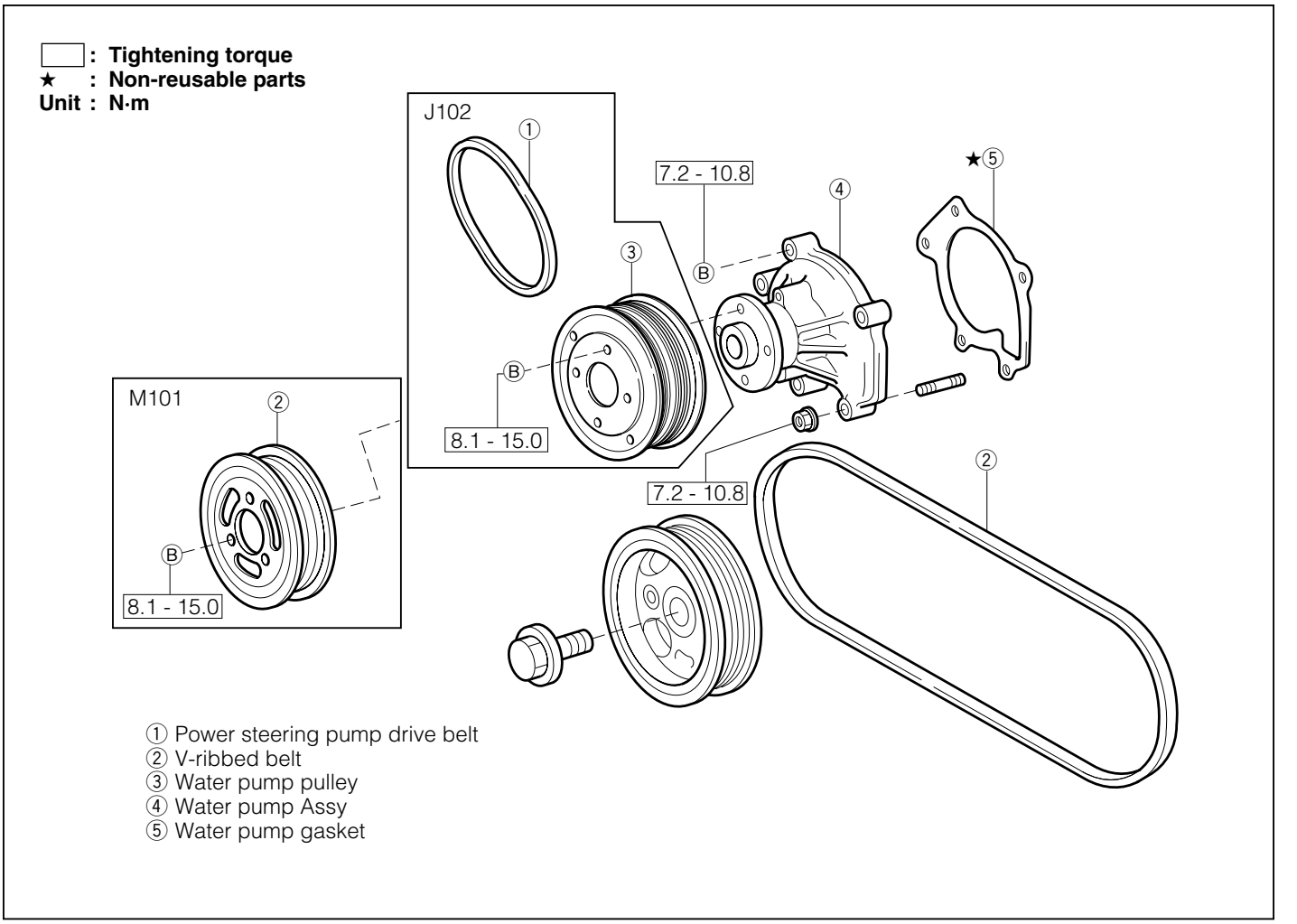

sCO00074-00053

(10) Warm up the engine until the cooing fan operates twice, and then stop the engine.
(11) After the engine has cooled down, fill the radiator with the coolant and add the coolant up to the full level of the reserve tank.

sCO00075-00000

# WATER PUMP

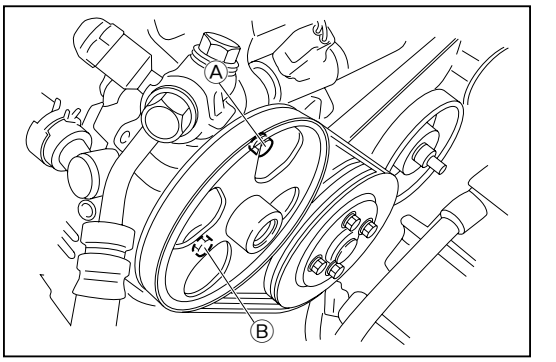
## COMPONENTS




JCO00018-00016

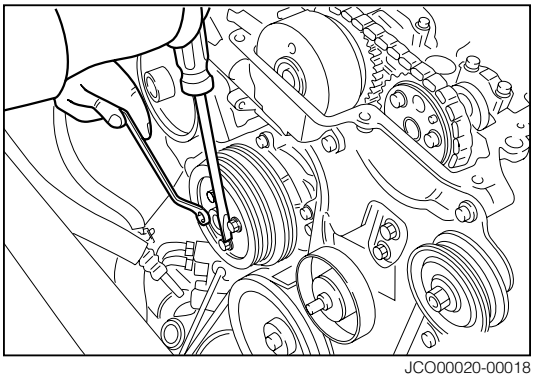
## REMOVAL

1. Drain the engine coolant. (Refer to page CO–3.)
2. Remove the drive belt. (Refer to the CH section.)
3. Remove the power steering pump drive belt. (J102 only)
   (1) Loosen the bolts Ⓐ and Ⓑ.
   (2) Remove the power steering pump drive belt by moving the power steering pump.




JCO00019-00017

4. Remove the water pump pulley while preventing it from turning, using a screwdriver or the like, as indicated in the right figure.
5. Remove the water pump Assy and gasket.



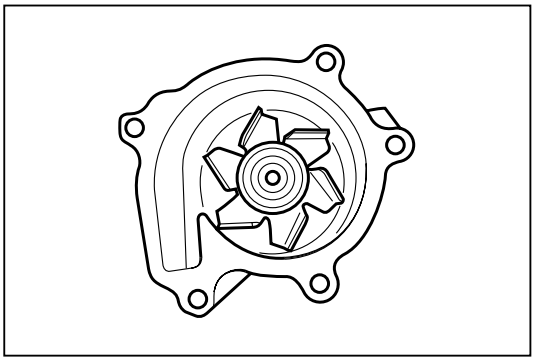
JCO00020-00018

## INSPECTION

1. Check the water pump pulley for damage or deformation.
   Replace the water pump pulley if it exhibits damage or deformation.

JCO00022-00000

2. Visually inspect the water pump rotor for damage or deformation.
   Replace the water pump if the water pump rotor exhibits damage or deformation.
3. Ensure that the water pump rotates smoothly by hand.
   Replace the water pump if it will not rotate smoothly.
4. Visually inspect the water pump pulley seat for damage or deformation.
   Replace the water pump if it exhibits damage or deformation.

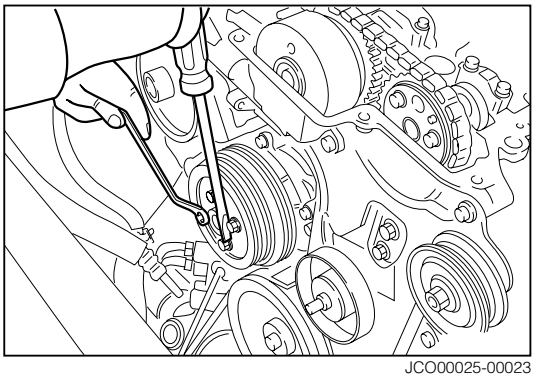


JCO00023-00021

## INSTALLATION

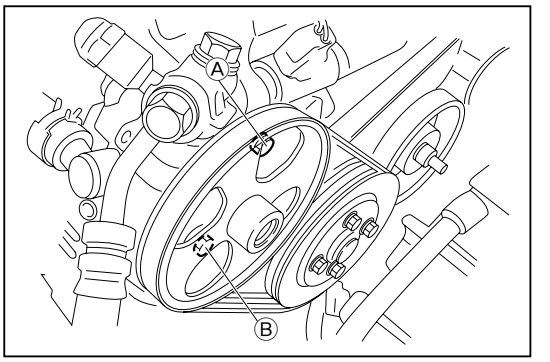
1. Install the water pump assembly and gasket.
   Tightening Torque: 7.2 - 10.8 N·m

2. Install the water pump pulley while preventing it from turning, using a screwdriver or the like, as indicated in the right figure.
   Tightening Torque: 8.1 - 15.0 N·m



JCO00025-00023

3. Install the power steering pump drive belt. (J102 only)
   (1) Install the power steering pump drive belt between the water pump pulley and the power steering pump pulley.
   (2) Adjust the tension by moving the power steering pump.
   (3) Tighten the bolts Ⓐ and Ⓑ.
   Tightening Torque: 34.4 - 52.0 N·m




JCO00026-00024

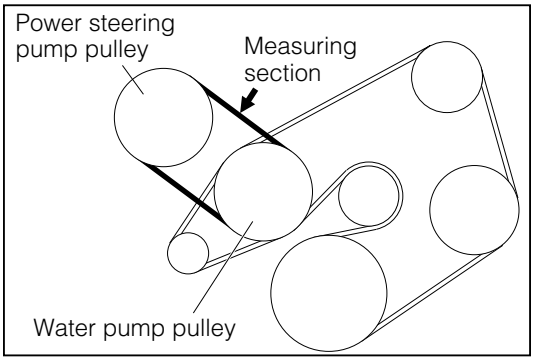
(4) Check the tension of the power steering pump drive belt.

Specified Value

| | New belt | Used belt |
|---|---|---|
| Belt deflection amount | 7.0 - 9.0 mm | 9.0 - 11.0 mm |
| Belt tension | 294 - 392 N | 196 - 294 N |

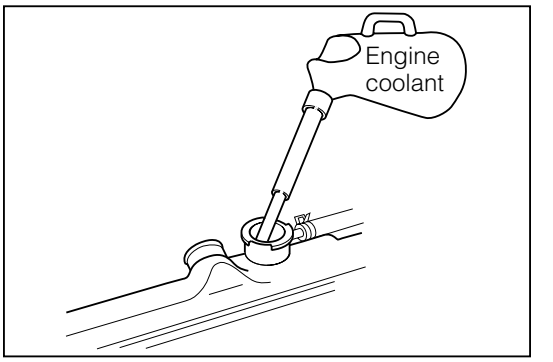
NOTE:

- When the belt deflection amount is measured, the measurement should be carried out with a force of 98 N applied between the designated pulleys in the right figure.
- As regards the belt that has been used for more than five minutes, it should be adjusted according to the specified value for the used belt.



JCO00027-00025

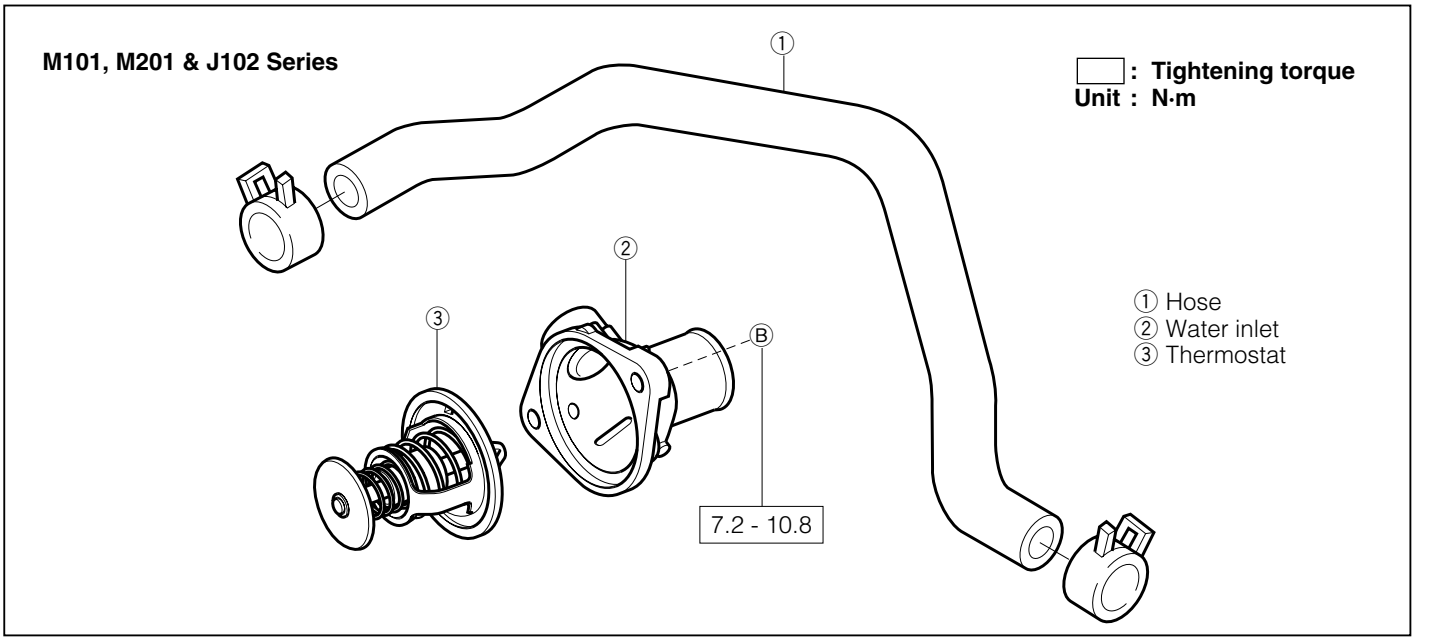
4. Install the drive belt. (Refer to the CH section.)
5. Fill engine coolant. (Refer to page CO–3.)



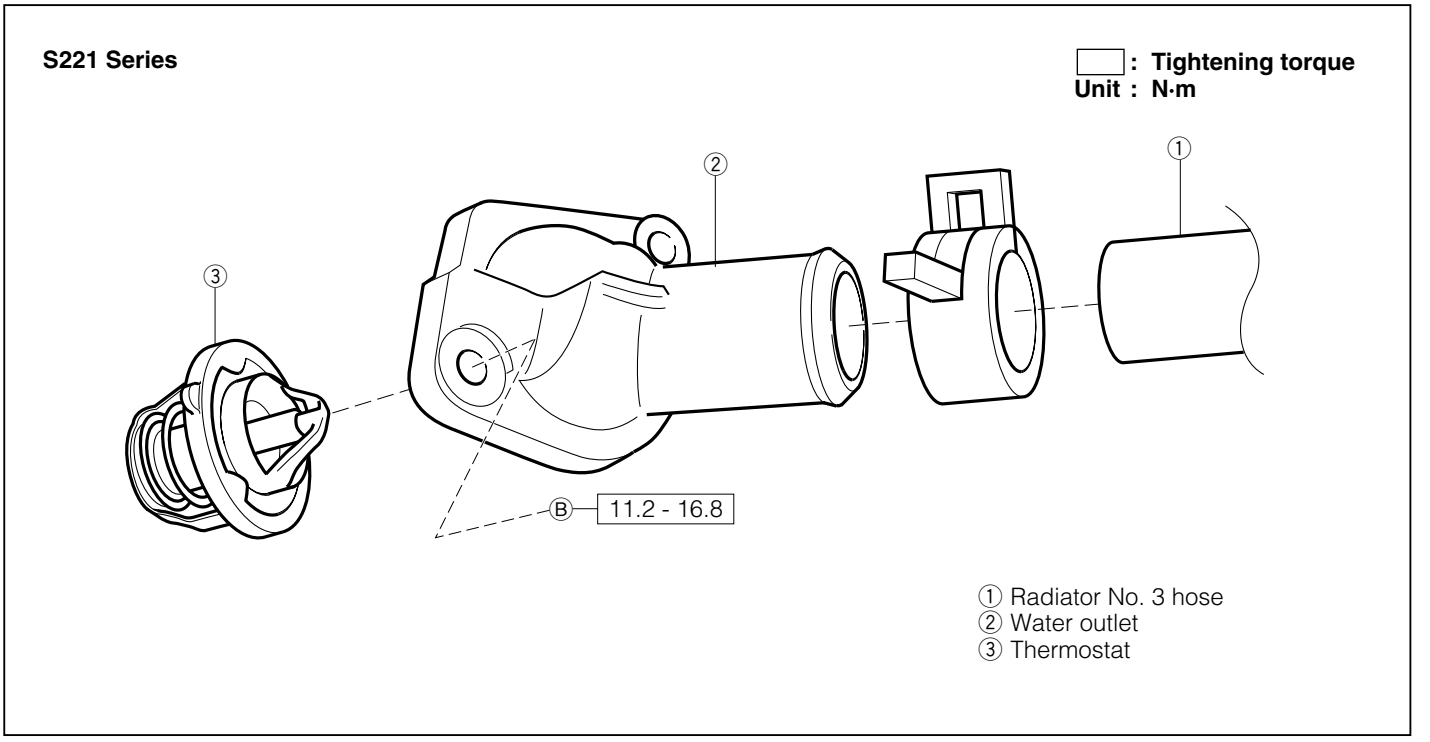
JCO00028-00026

# THERMOSTAT

## COMPONENTS




YCO00032-00024




YCO00000-00025

## REMOVAL

### M101, M201 & J102 Series

1. Drain the engine coolant. (Refer to CO–3.)
2. Disconnect the radiator thermo control switch connector. (Only for EU spec.)
3. Remove the water inlet from the cylinder head.
4. Remove the thermostat from the cylinder head.

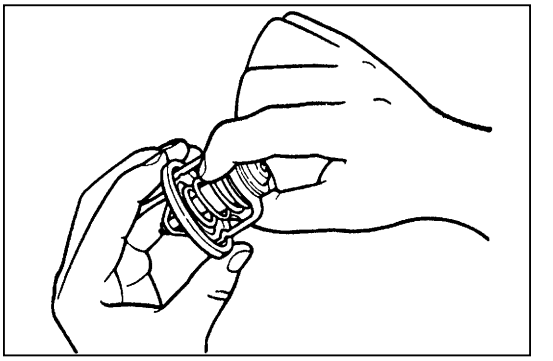
### S221 Series

1. Drain the engine coolant (Refer to CO–3.)
2. Remove the water outlet from the cylinder head.
3. Remove the thermostat from the cylinder head.

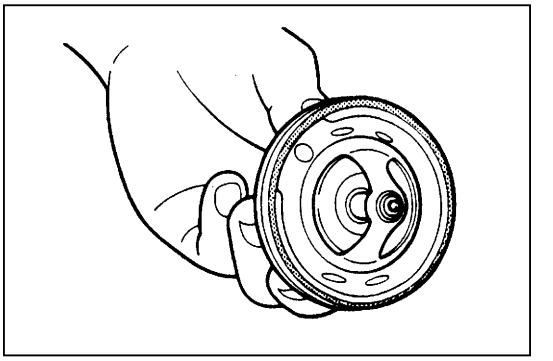
YCO00033-00000

## INSPECTION

1. Ensure that the thermostat valve is closed at room temperature of 20°C and the spring has no play.
   Replace the thermostat if the valve is open or the spring has a play.

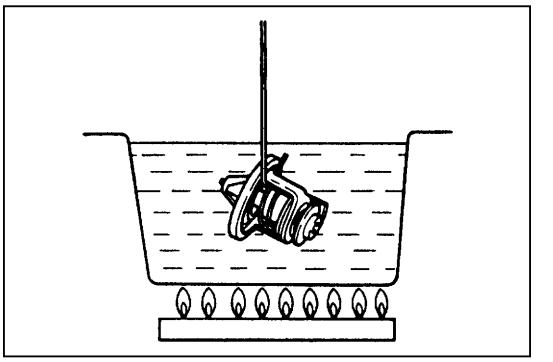

YCO00034-00026

2. Check the rubber grommet of the thermostat for damage or crack.
   Replace the thermostat if the rubber grommet exhibits damage or crack.

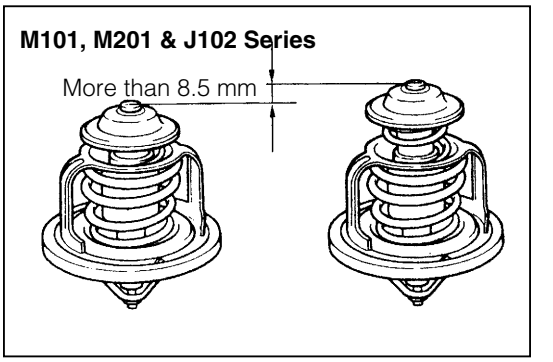

YCO00035-00027

3. Check of thermostat valve opening temperature
   (1) Immerse the thermostat in water, as indicated in the right figure. Heat the water gradually. Ensure that the temperature at which the valve begins to open conforms to the specified value.
   Specified Valve Opening Temperature:
   M101, M201 & J102 Series: 80 ± 2°C
   S221 Series: 88 ± 1.5°C

   If the temperature fails to conform to the specification, replace the thermostat with a new one.

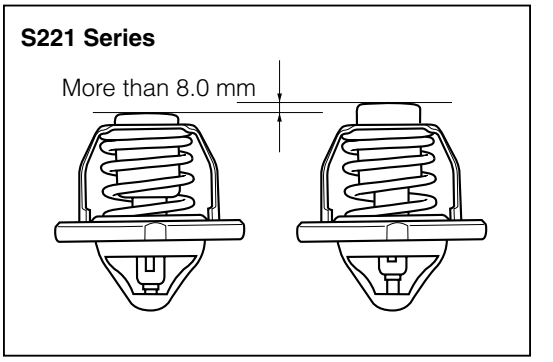

YCO00036-00028

   (2) M101, M201 & J102 Series
   Under the condition described in the step (1), heat the water to 93°C. At this time, ensure that the valve lift is the specified value or more.
   Specified Value: More than 8.5 mm



YCO00037-00029

   S221 Series
   Under the condition described in the step (1), heat the water to 100°C. At this time, ensure that the valve lift is the specified value or more.
   Specified Value: More than 8.0 mm



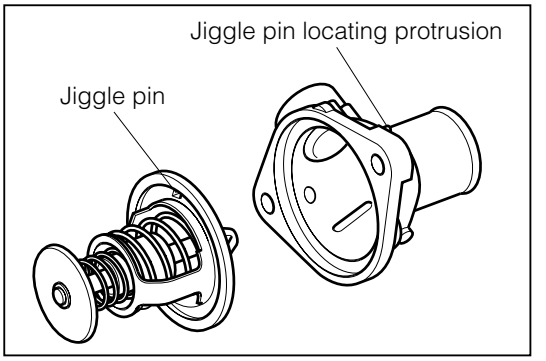
YCO00000-00030

CAUTION:
- Be very careful not to get scalded, for the heated thermostat will be very hot.

## INSTALLATION

### M101, M201 & J102 Series

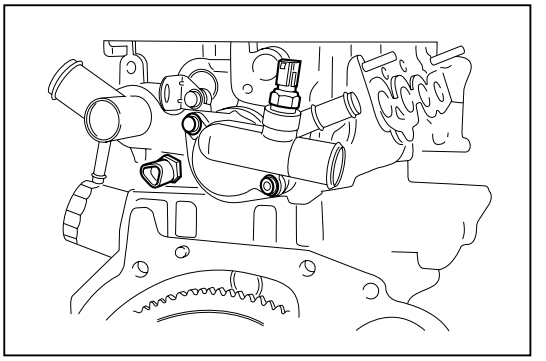
1. Install the thermostat to the water inlet.
   NOTE:
   - Be sure to assemble the thermostat at the position indicated in the right figure.



YCO00076-00054

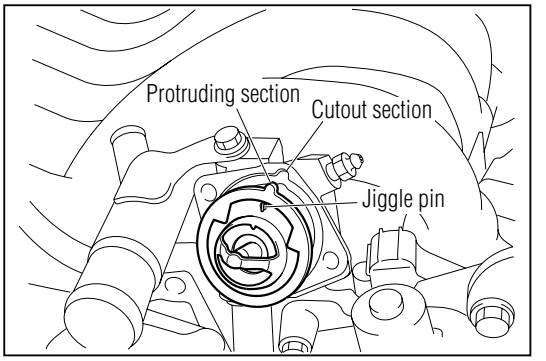
2. Install the water inlet to the cylinder head.
   Tightening Torque: 7.2 - 10.8 N·m

3. Connect the radiator thermo control switch connector. (Only for EU spec.)
4. Fill the engine coolant. (Refer to page CO–3.)
5. Start the engine. Ensure that no water leakage is present.


YCO00077-00055

### S221 Series

1. Assemble the thermostat to the water outlet with its jiggle pin facing upward.

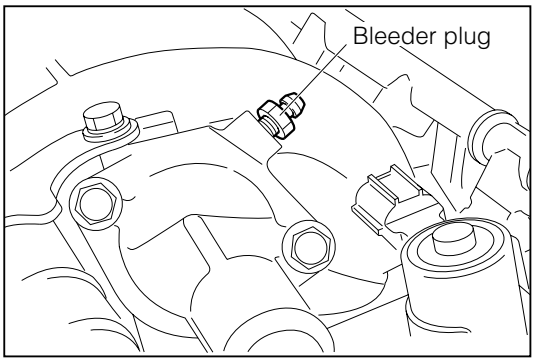


YCO00040-00032

2. Install the water outlet to the water outlet housing.
   Tightening Torque: 11.2 - 16.8 N·m

3. Install the water outlet housing to the cylinder head.
   Tightening Torque: 16.0 - 24.0 N·m

4. Fill the engine coolant. (Refer to page CO–5.)
5. Start the engine. Ensure that no water leakage is present.



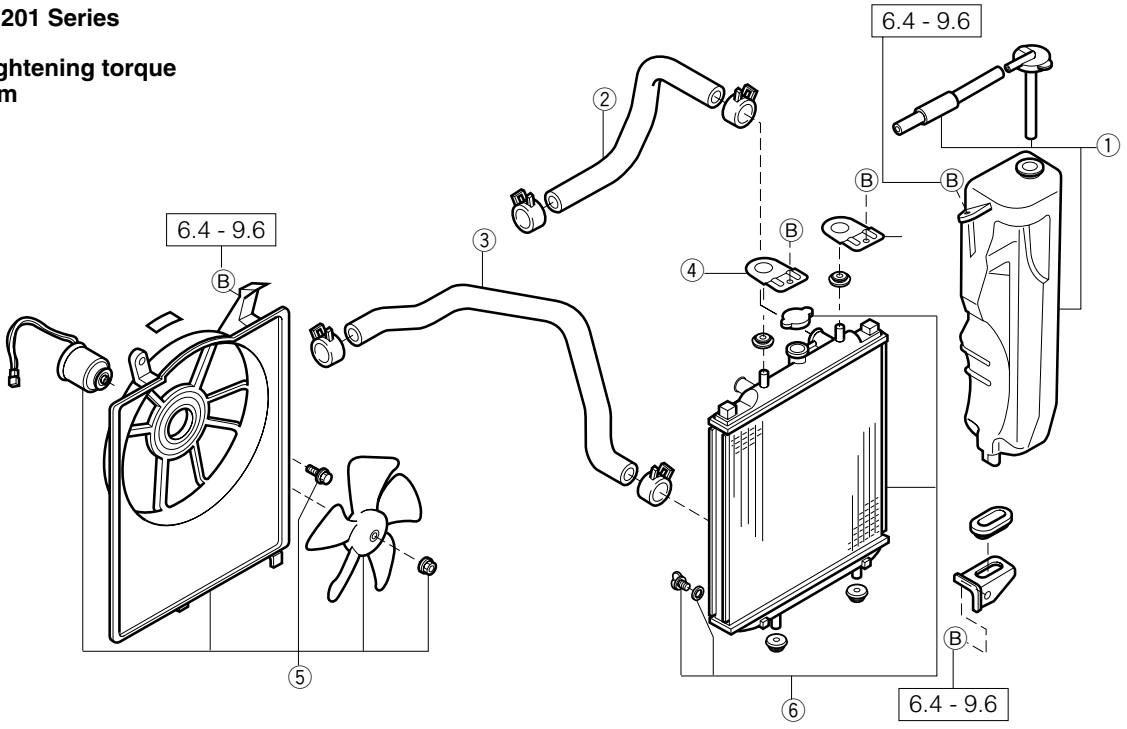
YCO00042-0003

# RADIATOR

## COMPONENTS

**M101 & M201 Series**

**□ : Tightening torque**
**Unit : N·m**

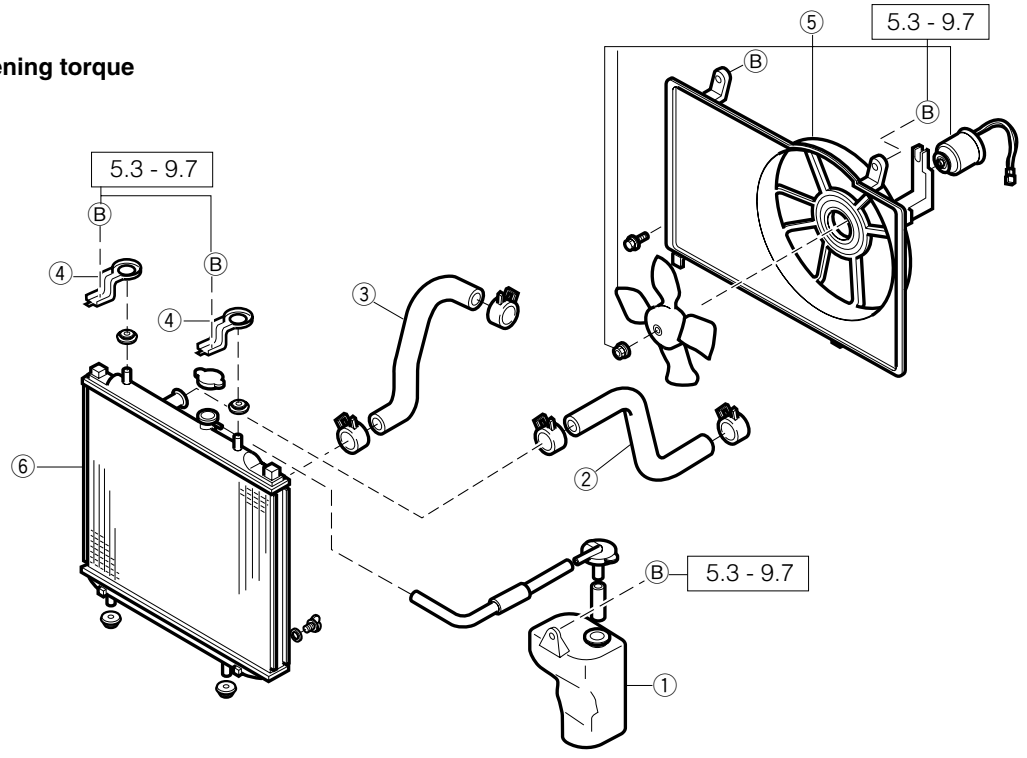



① Radiator reserve tank
② Radiator inlet hose
③ Radiator outlet hose
④ Radiator bracket
⑤ Fan motor assy
⑥ Radiator assy

YCO00043-00035

**J102 Series**

**□ : Tightening torque**
**Unit : N·m**

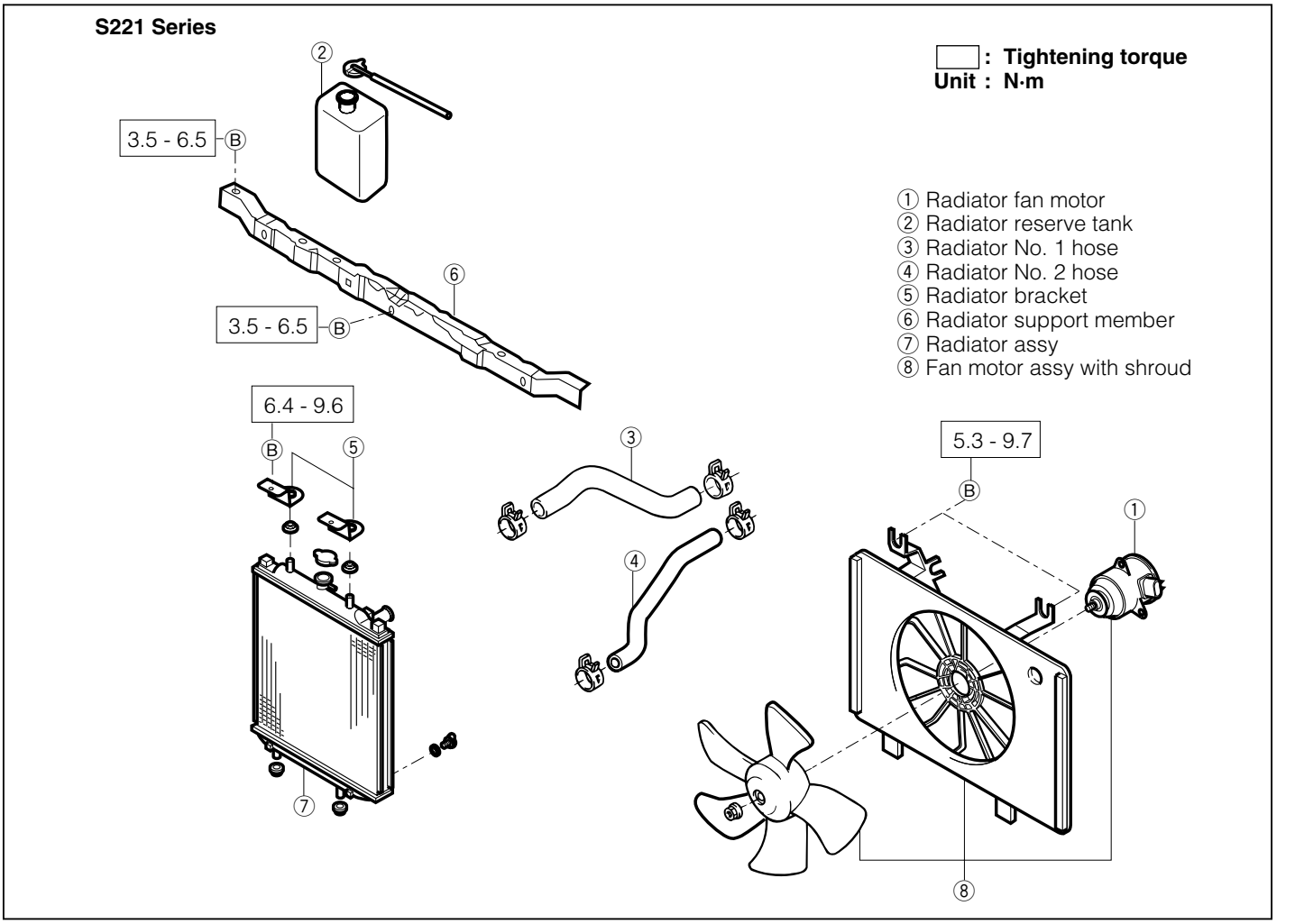



① Radiator reserve tank
② Radiator inlet hose
③ Radiator outlet hose
④ Radiator bracket
⑤ Fan motor assy
⑥ Radiator assy

YCO00000-00056

# RADIATOR (S221)

## COMPONENTS (S221)




YCO00046-00036

## REMOVAL

### M101, M201 & J102 Series

WARNING:
- Never remove the radiator cap and drain plug when the engine coolant is still hot.

1. Disconnect the cable from the negative (–) terminal of the battery.
   NOTE:
   - It should be noted that the diagnosis results and memory in the radio, etc. will be erased when the cable is disconnected from the negative (–) terminal of the battery.

2. Remove the engine undercover.
3. Drain the engine coolant. (Refer to page CO–3.)
4. Remove the front bumper.
5. Remove the condenser. (air conditioner.)
   NOTE:
   - Be very careful not to disconnect the pipes that have been connected to the condenser.

6. On automatic transmission vehicles, disconnect the oil cooler hose.
7. Disconnect the radiator inlet hose and radiator outlet hose at the radiator side.
8. Remove the radiator bracket and coupler of the fan motor.
9. Remove the fan motor assembly and radiator assembly as a set.

YCO00078-00000

**S221 Series**

WARNING:
- Never remove the radiator cap and drain plug when the engine coolant is still hot.

1. Disconnect the cable from the negative (–) terminal of the battery.
   NOTE:
   - It should be noted that the memories of diagnosis results, radio, etc. will be erased at same time when the cable is disconnected from the negative (–) terminal of the battery.
2. Drain the coolant.
3. Remove the front grille and front bumper.
4. Remove the hood lock.
5. Disconnect the oil cooler hose. (A/T)
6. Disconnect the radiator hoses No. 1 and No. 2.
7. Remove the radiator bracket.
8. Remove the radiator support upper member.
9. Remove the radiator assembly.
10. Remove the fan motor assembly with shroud.
    NOTE:
    - When the radiator assembly is removed, be sure to lift the radiator assembly while pulling the condenser (for air conditioner) toward your side.
    - Do not disconnect the pipes of the condenser (for air conditioner).

YCO00047-00000

## INSTALLATION

**M101, M201 & J102 Series**

1. Install the fan motor assembly and radiator assembly as a set.
2. Install the radiator bracket.
3. Install the coupler of the fan motor.
4. Connect the radiator inlet hose and radiator outlet hose to the radiator.
5. On automatic transmission vehicles, connect the automatic transmission oil cooler hose to the radiator. (Refer to the A/T section.)
6. Install the condenser. (air conditioner.)
7. Fill engine coolant. (Refer to page CO–3.)
8. Install the front bumper.
9. Install the engine undercover.
10. Connect the cable to the negative (–) terminal of the battery.
11. Check the radiator for leakage.

YCO00049-00000

**S221 Series**

1. Install the fan motor assembly and radiator assembly as a set.
2. Install the radiator.
3. Install the radiator bracket.
4. Install the coupler of the fan motor.
5. Connect the radiator No. 1 hose and radiator No. 2 hose to the radiator.
6. On automatic transmission vehicles, connect the automatic transmission oil cooler hose to the radiator. (Refer to the A/T section.)
7. Install the hood lock.
8. Install the front grille and bumper.
9. Fill engine coolant. (Refer to page CO–3.)
10. Connect the cable to the negative (–) terminal of the battery.
11. Check the radiator for leakage.

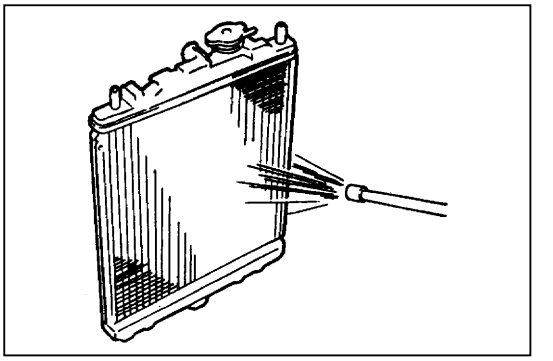
sCO00052-00000

## CLEANING OF RADIATOR

Using water or steam cleaner, remove mud and dirt from the radiator core.

CAUTION:

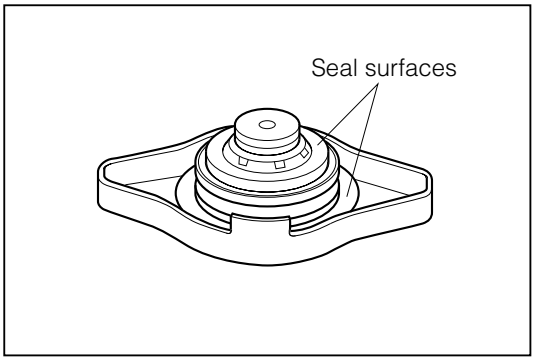
- When using a high-pressure type cleaner, be very careful not to deform the radiator core fins.
- Keep a distance of more than 40 - 50 cm between the radiator core and the cleaner nozzle when the cleaner nozzle pressure is 2.9 - 4.9 MPa.
- Also, the injection angle of pressurized water should be right angles to the radiator.
- Failure to observe this caution will cause the radiator fins to be deformed.



sCO00053-00037

## INSPECTION OF RADIATOR

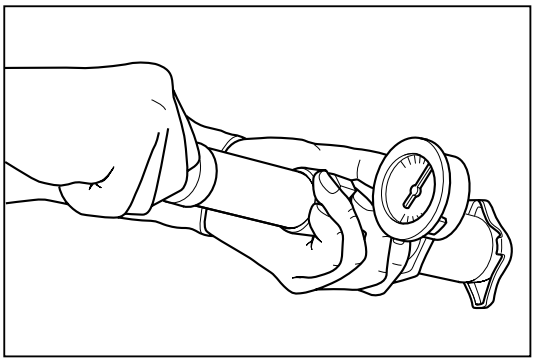
1. Check of radiator cap
   (1) Check the seal packing of the radiator cap for damage.
   Replace the radiator cap with a new one, if any damage exists.
   (2) Lift the valve at the vacuum side with your fingers.
   Ensure that the valve is functioning properly.
   Replace the radiator cap with a new one, if the valve fails to function.
   (3) Check the radiator cap by means of a radiator cap tester to see if the relief valve opens at a pressure of 108 ± 15 kPa.
   If the radiator cap fails to conform to the specification, replace the radiator cap.




sCO00054-00038

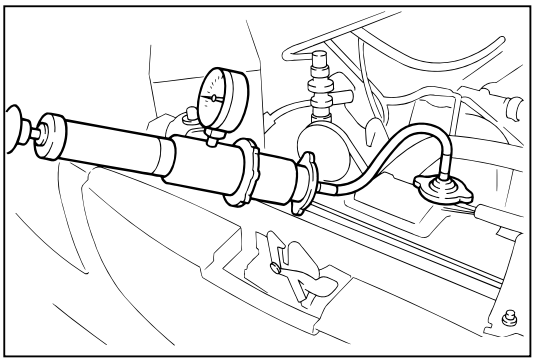
CAUTION:

- Never open the radiator cap when the engine is still hot.
- Failure to observe this caution will cause you to get scalded.



sCO00055-00039

2. Check of cooling system for leakage
   (1) Fill the radiator with coolant. Attach a radiator cap tester.
   (2) Warm up the engine.
   (3) Apply a pressure of 122.7 kPa to the cooling system by means of the radiator tester.
   If the pressure drops, check the hoses, radiator, water pump and heater for evidence of leakage.
   If no external leakage is found, check the heater core, cylinder block, cylinder head and throttle body for evidence of leakage.
   Check the hoses for deterioration, cracks, bulge or damage.
   Replace the defective part(s) if necessary.
   (4) Remove the radiator cap tester from the radiator.



sCO00056-00040

WARNING:

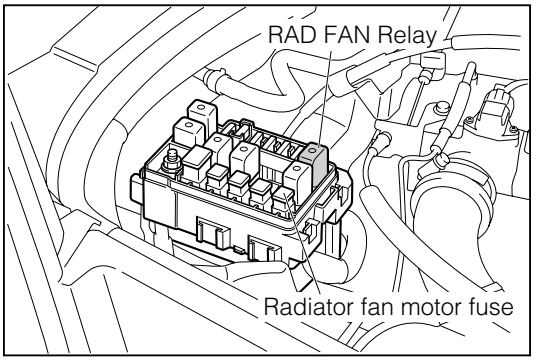
- Never open the radiator cap and/or drain cap when the coolant is still hot. Failure to observe this caution will cause you to get scalded.

sCO00057-00000

# ELECTRIC COOLING FAN

## IN-VEHICLE INSPECTION

1. If the fan motor is rotating when the coolant temperature is below 80°C and the ignition switch is at the off position, check the RAD FAN relay and the wiring harness for short.
   (1) Disconnect the RAD FAN relay from the relay Block (R/B).
   (2) If the fan motor stops, check the RAD FAN relay.
   (3) If the fan motor is rotating, check the wiring harness for short.
2. Turn on the ignition key switch. Ensure that the fan is not rotating when the coolant is cold (below 80°C). If the fan motor is rotating, check the engine coolant temperature sensor and radiator thermo control switch (EC spec.).
3. Warm the engine, until the radiator coolant temperature rises above 100°C. Ensure that the fan motor is rotating. If the fan motor is not rotating, check the RAD FAN relay, wiring harness, radiator fan motor fuse, radiator fan motor, water temperature sensor and radiator thermo control switch (EC spec.).

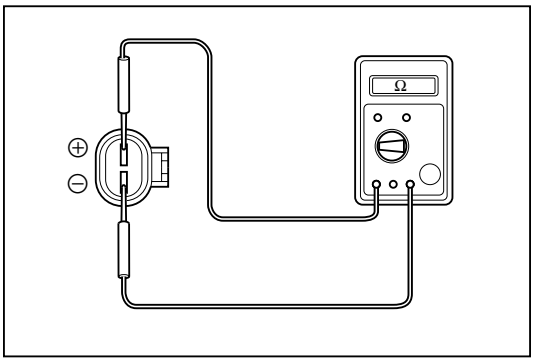


JCO00048-00046

JCO00049-00000

### Radiator fan motor check

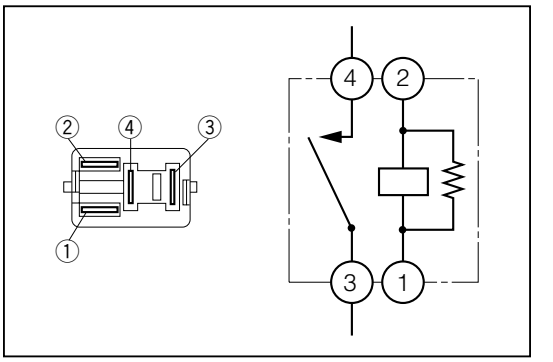
1. Disconnect the connector of the radiator fan motor.
2. Check resistance between the terminals of the radiator fan motor.
   Specified Value: Approx. 1.0 Ω



JCO00050-00047

### Radiator fan motor relay check

The radiator fan motor relay employs the same relay as the starter relay. Therefore, for the unit inspection, refer to the ST section.



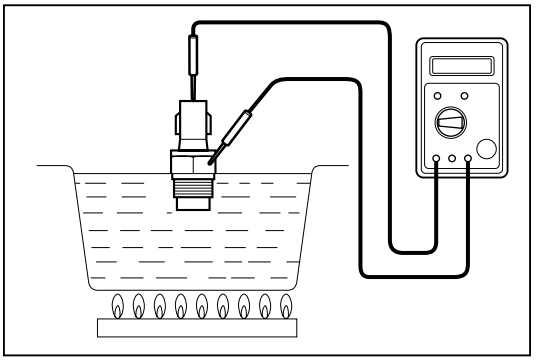
JCO00051-00048

### Engine coolant temperature sensor check

Refer to the “EF” section.

### Radiator thermo control switch check (EC specifications only)

1. Ensure that continuity exists between the terminals when the water temperature is 94°C or above.
   If there is no continuity, replace the radiator thermo control switch.
2. Allow the water temperature to drop. When the temperature becomes 83°C or below, ensure that no continuity exists between the terminals. If there is continuity, replace the radiator thermo control switch.


JCO00052-00049

# SPECIFICATIONS

| | | | |
|---|---|---|---|
| Coolant capacity ( ℓ ) (w/heater, W/O reserve tank) | M/T | M101, M201 | 3.80 |
| | | J102 | 5.80 |
| | | S221 | 6.50 |
| | A/T | M101, M201 | 3.80 |
| | | J102 | 5.72 |
| | | S221 | 6.70 |
| Reserve tank capacity ( ℓ ) | FULL | M101, M201 | 0.45 |
| | | J102 | 0.95 |
| | | S221 | 0.70 |
| | LOW | M101, M201 | 0.25 |
| | | J102 | 0.18 |
| | | S221 | 0.20 |
| Thermostat | Valve opening temperature | M101, M201, J102 | 80.0 ± 2.0°C |
| | | S221 | 88.0 ± 1.5°C |
| | Valve lift | M101, M201, J102 | 8.5 mm or more at 93°C |
| | | S221 | 8.0 mm or more at 100°C |
| Radiator cap | Relief valve opening pressure | 108 ± 15 kPa (1.1 ± 0.15 kg/cm$^2$) | |

YCO00064-00000

# TIGHTENING TORQUE

| Components | | N·m | kgf-m | Remarks |
|---|---|---|---|---|
| Water pump × Cylinder block | | 7.2 - 10.8 | 0.72 - 1.08 | |
| Water pump × Water pump pulley | | 8.1 - 15.0 | 0.81 - 1.50 | |
| Water inlet × Cylinder head | | 7.2 - 10.8 | 0.72 - 1.08 | M101, M201, J102 |
| Water inlet pipe × Cylinder block | | 6.3 - 11.7 | 0.63 - 1.17 | S221 only |
| Water outlet housing × Water outlet | | 11.2 - 16.8 | 1.12 - 1.68 | S221 only |
| Fan motor × Fan shroud | 80 W | 1.8 - 3.3 | 0.18 - 0.33 | |
| | 120 W | 2.7 - 5.0 | 0.27 - 0.50 | |
| Fan motor × Fan | | 4.9 - 7.4 | 0.49 - 0.74 | |
| Fan shroud × Radiator | | 6.4 - 9.6 | 0.64 - 0.96 | M101, M201 |
| Fan shroud × Radiator | | 5.3 - 9.7 | 0.53 - 0.97 | S221, J102 |
| Coolant reserve tank × Fan shroud | | 6.4 - 9.6 | 0.64 - 0.96 | |
| Radiator bracket × Support upper member | | 6.4 - 9.6 | 0.64 - 0.96 | S221 only |

YCO00065-00000

TO INDEX TO NEXT SECTION